Chapter Two

Land Use and Mobility: Moving Smarter, Improving Options and Changing Behavior

Key Learning Points

- The goal of transportation is *access*, not movement or mobility per se. Movement is a means, not the end.
- We need to drive less, and we need to drive smarter.
- There is no quick fix: success will rely on behavior change, new technologies, and transformation of development patterns.
- The largest percentage of greenhouse gas emission reductions will result from State- and regional-level initiatives.

How does gasoline consumption translate into greenhouse gas emissions?

1 gallon of gasoline = approximately 20 pounds CO_2e

You can use this information to calculate the greenhouse gas emissions you create by driving.

Chapter 2 - Land Use and Mobility

Introduction

Fremont is a geographically large city, covering approximately 90 square miles. Fremont's land use pattern is defined by the city's topography, its agricultural past, its early settlement patterns, its transportation network, and its central location within the nation's fourth largest major metropolitan area. In addition to the local street network, two interstate highways – Interstate 880 and Interstate 680 – connect Fremont to the Greater Bay Area and beyond. Three State highways – State Route (SR) 84, SR 262, and SR 238 – also pass through the city.

In general, industrial uses are concentrated in the south and southwestern portions of the city. Commercial uses are clustered in the five original districts - Centerville, Irvington, Niles, Mission San Jose, and Warm Springs - in shopping centers along arterial streets, around freeway interchanges, and in the city center. Residential uses occur throughout the city, with low-density single family neighborhoods and garden apartment complexes predominating. Public facilities such as fire stations and parks are located in all parts of the city, serving surrounding neighborhoods and, in some cases, the city as a whole.

Fremont's well defined road hierarchy, characterized by high-volume arterials, moderate-volume collector streets, and low-volume local streets serving residential neighborhoods, was built in part to link the five original districts to one another and to facilitate the development of the city as a whole. Zoning regulations separated various land uses from one another and required ample parking at destinations, which precluded the installation of parking meters citywide. The overall goal was to make driving, and parking, as convenient as possible.

Now, more than half a century after Fremont's 1956 incorporation, the City Council has articulated a new vision for the future of the city as part of the updated General Plan: *"Fremont will serve as a national model of how an auto-oriented suburb can evolve into a sustainable, strategically urban, modern city."* A key component of this evolution is the policy emphasis on locating the city's highest-intensity employment and residential development near transit centers, such as BART stations (existing and planned) and the Centerville Train Station (served by the Altamont Commuter Express (ACE) train and Amtrak) and also along major transit corridors, such as Fremont Boulevard.

The linkage of land use and transportation is a key strategy for reducing vehicle miles traveled and lowering greenhouse gas emissions in the transportation sector. As urban designer Peter Calthorpe notes: ". . . the goal of transportation is access, not movement or mobility per se; movement is a means, not the end. So, bringing destinations closer together is a simpler, more elegant solution than assembling a new fleet of electric cars and the acres of solar collectors needed to power them. Call it 'passive urbanism.'"[1]

While Fremont is relatively well served with commute service to other employment centers throughout the Bay Area,[2] the viability of local transit service by AC Transit and Valley Transportation Authority (VTA) is hampered by population and employment densities lower than the minimum needed to support regular bus service in many areas of the city. This barrier to increased bus service can be addressed, in part, by encouraging denser development in targeted locations served by transit.

[1] Calthorpe, Peter. *Urbanism in the Age of Climate Change.* 2011, Island Press, p. 18.

[2] See, however, the discussion later in this chapter of Fremont's commute patterns and the low level of use of public transit.

The City's approach to achieving its vision is consistent with Senate Bill (SB) 375, the 2008 legislation aimed at linking transportation planning with land use planning and reducing greenhouse gas emissions, largely by promoting development density near urban cores and transit centers. Also, as mentioned in Chapter One of this Plan, the Public Policy Institute of California's 2010 report *Californians and the Environment* found that 77% of Californians favor encouraging local governments to change land use and transportation planning so that people can drive less. As part of the Fremont General Plan Update, the community was asked in an on-line survey where new population growth should be accommodated; the most popular response was 'in higher intensity development near transit.' At both the statewide and local levels, the public's preference is clear.

Fremont's strategies are also consistent with goals identified by California's *Health in All Policies Task Force* of the Strategic Growth Council (SGC). The SGC was created in 2010 by Governor Arnold Schwarzenegger and charged with identifying strategies for improving community health and advancing other SGC goals. These goals include encouraging infill and compact development, improving air quality and transportation, and assisting local and state entities in planning sustainable communities and meeting the goals of AB 32. In their December 2010 report, the Task Force included the aspirational goal that "All California residents have the option to safely walk, bicycle, or take public transit to school, work, and essential destinations."

The General Plan identified the following trends which have direct influence on the City's goal of reducing greenhouse gas emissions from vehicles:

- ***Economic:*** Over time job growth has outpaced housing growth, resulting in increases in housing costs and an imbalance between housing and jobs. ABAG projects this trend to continue. As a result, the General Plan establishes policies which will ensure adequate housing is provided near jobs, services, and transit.

- ***Land availability:*** Due to the limited supply of large parcels of vacant land, the majority of development activity will be infill projects on smaller vacant and underutilized parcels.

- ***Traffic congestion:*** Traffic congestion has increased on roads

within the city and throughout the region. This congestion is caused by daily commuting into and out of the city, and by trips to meet daily life needs.

- **Technology**: Driven in part by State and/or federal mandates, a wide range of technological innovations are currently deployed or under development. Examples include cleaner transportation fuels; advanced-technology vehicles (such as electric, hybrid, and plug-in electric) for personal and commercial use, as well as for public and transit agency fleets; and Intelligent Transport Systems, which use communication and electronic technologies to monitor traffic flow and enhance roads and freeways to help reduce congestion.

The Climate Action Plan provides specific strategies that acknowledge these trends in transportation. The Plan also acknowledges that ongoing regional planning efforts, state-level initiatives, and private-sector innovations are linked to the *synergy of strategies* - vehicle fuel economy, fuel carbon content, vehicle miles traveled, and optimization of the transportation system - to achieve GHG emission reductions in this sector, as discussed later in this chapter.

State of California: Statewide, the transportation sector uses about half of the energy consumed in the state, and produces about 36 percent of the state's greenhouse gas emissions.[3] While per capita electricity-related greenhouse gas emissions are significantly lower in California than the nationwide average, vehicle-related emissions are generally comparable. As a result, the transportation sector has been the primary focus of statewide efforts to reduce dependence on petroleum fuels, develop and deploy cleaner energy sources and cleaner vehicles, and lower greenhouse gas emissions. Major co-benefits of these goals are a reduced dependence on imported oil, cleaner air, and improved public health.

Three key pieces of State legislation driving many of the approaches to reducing greenhouse gas emissions in the transportation sector (as well as others) are Assembly Bill (AB) 1493, Assembly Bill 32, and Senate Bill (SB) 375. Each is referenced in greater detail in this chapter (as well as other chapters of the Climate Action Plan).

[3] California Energy Commission. 2010 Integrated Energy Policy Report Update. Publication Number: CEC-100-2001-001-CMF, 2011, pp. 13-14.

2005 Baseline Inventory of Greenhouse Gas Emissions from the Transportation Sector

Fremont's 2005 baseline inventory found that, when including vehicles on state highways and local roads, the transportation sector is responsible for about 60% of Fremont's greenhouse gas emissions. Motor vehicles driven within the City's geographical boundaries on both local and state roads emitted approximately 1,005,300 metric tons of CO_2e in 2005. About 66% of the emissions were from traffic on the state highways and about 34% resulted from traffic on local roads.

The methodology used for Fremont's baseline inventory reflected the current state-of-the-art in emissions modeling in the transportation sector, and by necessity included various assumptions about the vehicles whose miles were being counted. Despite the challenges of modeling emissions from transportation, the inventory results are useful for illustrating the relative emissions from different sources. While Fremont will continue to face challenges in measuring the effectiveness of policies and actions due to the limitations of emissions modeling techniques, it will seek to make use of the best available methods and models in this ongoing process.

The Synergy of Multiple Strategies: *There is No Quick Fix*

Greenhouse gas emission reductions in the transportation sector cannot be successfully mitigated through any single public policy or technological innovation. Similar to the metaphor used to describe California's approach to energy efficiency, many studies describe transportation-related emission reductions as a *three-legged stool* of **vehicle fuel economy** (the common metric expressed in *miles per gallon*, or MPG), the **carbon content of the fuel itself** (the lower the carbon content, the lower the greenhouse gas emissions produced); and the **amount the vehicle is driven** (referred to as *vehicle miles traveled*, or VMT). To these can be added a fourth leg, or strategy, of **optimization of the transportation system**, which addresses ways that roads, traffic signals and other elements of the system can be built, operated and maintained for maximum efficiency and functional capacity.

For transportation-related emissions, it is important to understand the synergistic relationship of the four strategies described above. Several examples of synergies include the following:

- While the reduction of VMT helps lower greenhouse gas emissions, it also helps reduce both traffic congestion and the frequency of pavement maintenance.

- Well-maintained road surfaces and efficient traffic flows maximize fuel efficiency.

- Improved fuel economy and the increasing use of alternative fuels reduce greenhouse gas emissions, while also decreasing air pollution, improving public health, and improving energy security.

The City can directly influence the third and fourth strategies of achieving reductions in vehicle miles traveled (through its authority over local land use decisions and other areas of influence) and optimizing the system (through the development, operation and maintenance of transportation infrastructure), whereas the first two strategies are within the purview of the federal and state governments and are implemented by utilities and vehicle manufacturers. In order to meet the City of Fremont's greenhouse gas emission reduction goals, each strategy must be addressed. If VMT continues its historical growth, the increase in driving could neutralize the environmental benefits garnered from lower-carbon fuels and an increasing number of lower-emission vehicles on the road.

Strategy One: *Better Cars* with Increased Fuel Economy and Other Efficiencies

Federal-level policy and regulation: The Corporate Average Fuel Economy (CAFE) standards are the foundation of U.S. policy addressing fuel economy of cars and light trucks[4]. These standards were first created by the Energy Policy Conservation Act in 1975, and were enacted by Congress in response to the Arab Oil Embargo and resulting tripling of fuel prices in 1973-74. The purpose of the CAFE standards, which are administered by the National Highway Traffic Safety Administration (NHTSA), is to reduce energy consumption by increasing the fuel economy of cars and light trucks. The standards are expressed as miles per gallon (mpg) figures.

[4] The light-duty vehicle class is defined by the Environmental Protection Agency as smaller vehicles (less than 8,500 pounds gross vehicle weight) ranging from subcompact cars and sedans to minivans, sport utility vehicles, and smaller (1/2 ton) pickup trucks. Medium-duty passenger vehicles are those between 8,500 and 10,000 lbs. GVW if they are designed and used primarily for transporting people.

In 2010, for the first time since the establishment of the CAFE standards, the NHTSA and the EPA jointly released requirements addressing both fuel mileage and greenhouse gas emissions for light duty vehicles, model years 2012 through 2016. This is an historic step in addressing the oil consumption and greenhouse gas emission contributions of the largest contributor (about 60% nationwide) in the transportation sector. By model year 2016, the average industry-wide compliance levels are projected to be 250 grams per mile carbon dioxide (CO_2) and 34.1 miles per gallon. Table 2-1, which includes calculated historic $C0_2$ emissions corresponding to the fuel economy standards of each year listed, illustrates the relationship between fuel economy and $C0_2$ emissions and the progress achieved since the program began.

Table 2-1: Carbon Dioxide Emissions and Miles per Gallon of Light Duty Vehicles under CAFE regulations

	1975	1987	1998	2008	2009	2010	2016 (projected)
Adjusted CO_2 emissions (grams /mile)	681	405	442	424	397	395	250
Adjusted Fuel Economy (miles per gallon)	13.1	22.0	20.1	21.0	22.4	22.5	34.1

Source: U.S. Environmental Protection Agency, *Light-Duty Automotive Technology, Carbon Dioxide Emissions, and Fuel Economy Trends: 1975 Through 2010*, *Executive Summary*, p. iii. Nov. 2010. Table modified to include 2016 projected emissions and fuel economy data.

The NHTSA and EPA have begun addressing standards, expected to be in place by 2014, for medium- and heavy-duty trucks, which are the nation's second-largest contributor to petroleum consumption and greenhouse gas emissions in the transportation sector.

State-level policy and regulation: At the State level, in 2002, California once again showed its national leadership by signing into law AB 1493, which directed the Air Resources Board (ARB) to adopt regulations requiring the maximum feasible and cost-effective reduction of greenhouse gas emissions from new light duty vehicles, beginning with model year 2009. This action pre-dated the federal government's 2010 inclusion of greenhouse gas emission requirements in the CAFE standards and was the first in the nation5 to set GHG standards for passenger vehicles. In response, in September 2004, ARB approved standards (known as Pavley I[6]) for model years 2009 through 2016, targeting 30 per cent reductions by 2016 (from a 2002 baseline). Pavley I took

[5] To date, fourteen other states have adopted California's standards.

[6] The standards are named after State Senator Fran Pavley (D-Santa Monica), who sponsored AB 1493.

effect for model years starting in 2009 to 2016. Pavley II, which is referred to as LEV (Low Emission Vehicle) III and is currently under development by ARB, will cover model years 2017 to 2025. The LEV III program reflects ARB's newly-adopted regulatory approach of combining the control of both greenhouse gas emissions and smog-causing pollutants from cars and light trucks into a coordinated package of standards.

In 2008, ARB issued a report[7] comparing the federal CAFE program and the State's Pavley standards. This report revealed that California's rules are more stringent than the federal regulations, and will result in substantially greater greenhouse gas emission reductions than would have occurred under CAFE standards only. For example, ARB estimates that between 2009 and 2016, the California standards will prevent emissions of 55 million metric tons of $C0_2e$ ($MMTCO_2e$) statewide - more than twice the 22 $MMTCO_2e$ prevented if only the new federal CAFE standards were implemented. By 2020, ARB estimates that the California rules will prevent 158 $MMTCO_2e$ statewide, double the 79 $MMTCO_2e$ reductions expected if only the federal standards were implemented.

The State of California utilizes a variety of approaches and programs to increase the use of alternative fuel sources and the number of zero- and low-emission vehicles driven in California. Examples include regulations and standards; funding for research, development and deployment; incentives for production of low-carbon alternative and renewable fuels; incentives to consumers for purchase of the vehicles; and a public outreach campaign showcasing the benefits and availability of the vehicles.

One important point in this discussion concerns vehicles that utilize electricity as a power source, such as all-electric vehicles, gas-electric hybrids, and plug-in electric hybrids. While driving these vehicles generates fewer emissions than gasoline-powered vehicles, some of the emission reductions are offset by the emissions which result from the production of the electricity which provides their power. Therefore, in order for these vehicles to achieve the **maximum potential reductions** in greenhouse gas emissions, **the electricity needs to come from renewable and/or low-carbon energy sources.** This highlights another synergy of California's efforts to reduce greenhouse gas emissions – in this case, the synergy between the Renewables Portfolio Standards (and other efforts aimed at reducing the carbon content of energy sources, described in Chapter Three) and the new technology vehicles which will maximize the potential emission reductions which can be achieved.

In addition to increased fuel economy, there are other ways to reduce greenhouse gas emissions. Collectively known as *vehicle efficiency measures*, these

[7] California Air Resources Board, *Comparison of Greenhouse Gas Reductions for the United States and Canada Under U.S. CAFE Standards and California Air Resources Board Greenhouse Gas Regulations: An Enhanced Technical Assessment.* February 25, 2008, pp. vi-vii.

include aerodynamic and lighter-weight vehicle design, low rolling-resistance tires, low friction engine oils, proper tire inflation, and solar-reflective automotive paint and window glazing (to keep cars cooler and reduce air conditioner use). The AB 32 Scoping Plan includes measures addressing several of these areas, and automobile manufacturers are currently marketing vehicles with innovative design strategies[8] which increase mile-per-gallon performance and reduce emissions at the same time.

Aerodynamic vehicle design reduces drag and increases fuel efficency.

The City of Fremont is actively engaged in increasing the number of alternative fuel vehicles in the City's fleet and retiring gasoline-powered vehicles whenever possible. These efforts, which help reduce greenhouse gas emissions from City operations and model leadership and commitment to the community, are described in more detail in Chapter Six.

Strategy Two: *Cleaner Fuels:* Shift to fuels that produce low or zero carbon dioxide emissions

The second strategy aimed at reducing greenhouse gas emissions from the consumption of fossil fuels addresses the carbon content of the fuel itself: the lower the carbon content, the lower the level of greenhouse gas emissions produced. For every gallon of gasoline consumed from driving, about 19 pounds of carbon dioxide are emitted into the air.[9] For every gallon of diesel fuel consumed, about 22.2 pounds of carbon dioxide are released. The EPA estimates the annual greenhouse gas emissions for a light-duty vehicle averaging approximately 20 miles per gallon and driven 12,000 miles per year to be 5.5 metric tons $C0_2e$. As noted in the State Alternative Fuels Plan (which identifies strategies to increase the use of alternative fuels): "California's transportation sector is more than 95 percent dependent on a single fuel source, petroleum, and over 60 percent of the nation's petroleum consumption comes from foreign

[8] One example of an innovative strategy is the Chevrolet Cruze Eco's lower grill air shutters that use sensors to sense wind and temperature conditions. Electric motors hooked to the sensors close them at high speeds to reduce drag, and open them at lower speeds to let in air to cool the engine – a design feature that increases fuel economy by nearly ½ mile per gallon.

[9] This figure increases by approximately five pounds to a total of 24 pounds of $C0_2$ per gallon, when the emissions released during drilling, refining and distributing the gasoline are accounted for. The higher figure represents the full fuel cycle impact of the gasoline's use (also known as the 'well-to-wheel' impact).

sources. . . The state and the nation are extremely vulnerable to petroleum price and supply disruptions at a time when crude oil prices exceed $90 per barrel."[10] Given that, in 2010, Californians consumed about 16 billion gallons of gasoline and 4 billion gallons of diesel fuel, the opportunities and the challenges for reducing the use of fossil fuels and lowering greenhouse gas emissions, while also reducing the state's vulnerability to price increases and supply disruptions, are phenomenal.

In 2007, Governor Schwarzenegger signed Executive Order S-01-07, which established the Low Carbon Fuel Standard (LCFS) for surface transportation fuels sold in California. The Air Resources Board adopted the standard, which requires fuel suppliers and distributors to ensure that, on average, the mix of fuel they sell into the California market meets a declining standard for GHG emissions, with the ultimate target of 10 percent reduction in carbon intensity of their fuel mix by the year 2020. According to a 2007 study,

> We find it possible to either manufacture a significant amount of low-carbon fuel within California or to import it from outside the state. Many of the low carbon fuels expected to be commercially available in large quantities within the 2020 time horizon are biofuels... (p. 9). In addition to these reductions in carbon intensity in the light duty fleet, vehicles that use diesel fuel today (heavy duty on-road vehicles and a wide variety of off-road applications like forklifts and construction equipment) might use low-carbon fuels. Three strategies seem feasible, low-GHG diesel fuels, natural gas, and electrification.[11]

Other fuel sources which could contribute to the LCFS and reduce the use of some gasoline and diesel fuel include natural gas, liquefied petroleum gas (LPG), electricity, and hydrogen.

As described in Chapter One, on December 29, 2011, the U.S. District Court for the Eastern District of California issued several rulings in the federal lawsuits challenging the Low Carbon Fuel Standard. The Court ruled that the LCFS violated the Commerce Clause of the U.S. Constitution. Soon after the court issued its ruling, the California Air Resources Board declared that it will seek a stay of the preliminary injunction when it appeals the decision. In the interim ARB has stated that it will withhold enforcement of the LCFS requirements.

[10] Throughout 2011, crude oil prices were up 25 percent from a year prior, averaging over $100 a barrel. The U.S. Energy Efficiency Administration's website noted: "Energy price forecasts are uncertain."

[11] Farrell, Alexander E., (UC Berkeley) and Sperling, Daniel, (UC Davis) Project Directors. "A Low-Carbon Fuel Standard for California: Part 1: Technical Analysis, August 1, 2007", p. 12.

Strategy Three: *Smarter Travel:* Reducing Vehicle Miles Traveled

Land use influences people's travel behavior because the location of housing, jobs, stores, services, and civic, educational and recreational facilities, all affect the frequency and distance of people's trips. The City of Fremont has local authority over the land use patterns of the community. As described earlier in this chapter, the policy emphasis on locating the city's highest-intensity employment and residential development near transit centers, such as BART, is intended to play a key role in reducing vehicle miles traveled. However, it is important to note that, while optimal land use patterns make possible travel choices which reduce greenhouse gas emissions, it is ultimately the accumulation of individual behaviors – the choices people make about how they move around - that will largely determine the level of emission reductions that occur.

The potential impact of behavior change should not be discounted or underestimated. Working Group III of the Intergovernmental Panel on Climate Change (IPCC) made the following findings about the role of behavior on mitigating climate change impacts in all sectors in the short- to- medium term (defined by the Panel as extending to 2030):

"Changes in lifestyle and behaviour patterns can contribute to climate change mitigation across all sectors. Management practices can also have a positive role.

- Lifestyle changes can reduce GHG emissions. Changes in lifestyles and consumption patterns that emphasize resource conservation can contribute to developing a low-carbon economy that is both equitable and sustainable.

- Education and training programmes can help overcome barriers to the market acceptance of energy efficiency, particularly in combination with other measures.

- Changes in occupant behaviour, cultural patterns and consumer choice and use of technologies can result in considerable reduction in $C0_2$ emissions related to energy use in buildings.

- Transport Demand Management, which includes urban planning (that can reduce the demand for travel) and provision of information and educational techniques (that can reduce car usage and lead to an efficient driving style) can support GHG mitigation.

- In industry, management tools that include staff training, reward systems, regular feedback, and documentation of existing practices can help overcome industrial barriers, reduce energy use, and GHG emissions."[12]

[12] IPCC, 2007: Summary for Policymakers. In: Climate Change 2007: Mitigation.

The vital link between land use and transportation was the foundational concept underlying Senate Bill (SB) 375, adopted by the California legislature in 2008. For the nine-county San Francisco region, the bill requires the Metropolitan Transportation Commission (MTC), the regional transportation planning agency, and the Association of Bay Area Governments (ABAG), the regional planning agency, to adopt a *Sustainable Communities Strategy* (SCS) which integrates MTC's *Regional Transportation Plan* (RTP) with ABAG's *Regional Housing Needs Allocation* process. The SCS must attempt to identify areas within the region which would ultimately provide sufficient housing for all of the region's population. The SCS must also attempt to coordinate the resulting land-use pattern with the transportation network, in order to achieve a 15% per capita reduction in greenhouse gas emissions from light-duty vehicles (automobiles and light trucks).[13]

In addition to this target, MTC and ABAG have adopted other performance targets for the SCS/RTP. Of these, the following have the potential to reduce greenhouse gas emissions as well:

- Increasing the average daily time walking or biking per person for transportation by 60% (for an average of 15 minutes per person per day)
- Decreasing average per-trip travel time by 10% for non-auto modes of travel
- Decreasing automobile vehicle miles traveled per capita by 10%
- Maintaining the transportation system in a state of good repair by:
  - Increasing local road pavement condition index to 75 or better
  - Decreasing distressed lane-miles of state highways to less than 10% of total lane miles
  - Reducing average transit asset age to 50% of useful life.

The primary goal of the SCS is to promote development density near transit and within urban centers. While the SCS is intended to support consensus on

Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, p. 12. B. Metz., O.R. Davidson, P.R. Bosch, R. Dave, L.A. Meyer (eds.), Cambridge University Press, Cambridge, United Kingdom and New York NY, USA.

[13] Technically, SB 375 calls for a reduction in emissions from passenger vehicles beyond the reductions expected from improvements in vehicle efficiency and the use of low-carbon fuels described earlier in this chapter.

a preferred growth pattern for the region, SB 375 explicitly provides that local governments are not required to update their general plans in accordance with the SCS. Therefore, the SCS does not carry the same authority as the Regional Housing Needs Allocation process. The process of developing the SCS/RTP was underway during the preparation of this Climate Action Plan. Adoption of the SCS/RTP is anticipated to occur in 2013.

The Sustainable Communities Strategy, Regional Transportation Plan, and Regional Housing Needs Allocation processes primarily address future development. However, since Fremont is largely developed, it is necessary to consider the current population's transportation-related behaviors. Data from the 2000 census (the most recent available at the time of the preparation of the Climate Action Plan) showed that an overwhelming majority of Fremont residents—over 77 percent—travel to work by driving alone. About 12 percent of the city's residents carpool and five percent take public transportation. Less than three percent of Fremont residents work at home and less than two percent walk or bicycle to work. This commute-related data highlights the tremendous challenges facing the community if it is to achieve measurable reductions in travel behaviors that produce greenhouse gas emissions. For non-commute vehicle trips, replacing these trips with different means of transportation would be ideal; however, other strategies, such as changes in driving habits (combining several errands into one trip and eliminating rapid acceleration and braking) can also help reduce both vehicle miles traveled and greenhouse gas emissions.

Transportation pricing is another policy approach aimed, in part, at reducing vehicle miles traveled. Transportation pricing refers to programs that seek to offset the hidden costs and impacts of driving, which include **environmental costs** (such as air pollution and increased greenhouse gas emissions) and **societal costs** (such as traffic congestion and longer travel times, resulting in higher fuel and vehicle maintenance costs; health impacts from dirtier air; increased wear and tear on the roadways, resulting in higher maintenance costs; and increased accident rates). Transportation pricing programs are designed to incorporate the *full* cost of driving (beyond those paid directly by the consumer, such as vehicle purchase, maintenance, insurance, fuel costs, tolls) into an individual's decision to drive. Transportation pricing policies can be used to shift the mitigation costs of these impacts to single-occupancy drivers; they can also provide incentives and/or rewards to those who use public transportation, non-motorized forms of travel, or collective travel as carpooling and vanpooling.

Toll crossing, San Francisco Bay Bridge.

Examples of transportation pricing include parking fees, pay-as-you-drive motor vehicle insurance, conversion of the motor fuel excise tax to a comprehensive energy user fee indexed to average vehicle efficiency, and congestion pricing, such as the toll pricing system on the Oakland –San Francisco Bay Bridge.[14] Many transportation pricing strategies are outside of the City's authority, although Fremont could choose to take an advocacy position on strategies proposed by other agencies. The Climate Action Plan includes several actions which take an incentive-based approach to redistributing Fremont's highly-skewed commute pattern away from solo drivers towards increased use of transit, carpooling, bicycling and walking. The Plan also seeks to expand the use of workplace policies that encourage and reward these behaviors while also increasing flexibility about when and where employees work.

Strategy Four: *Optimize the System*

Street repaving by City of Fremont Crew

The fourth strategy supporting the reduction of greenhouse gas emissions from the transportation sector concerns the transportation system itself. Since a vehicle sitting in traffic consumes more energy and emits more greenhouse gas emissions relative to the overall distance traveled, reducing delays and maintaining optimal traffic flow can help reduce emissions. The City of Fremont builds, operates and maintains the public street system; therefore, the City can posi-

[14] In 2010, tolls on the bridge for light-duty vehicles were changed to $6 during weekday peak commute hours (but only $2.50 for carpools with three or more passengers during weekday peak commute hours) dropping to $4 during off-peak hours on weekdays and $5 on Saturday and Sunday.

tively influence system optimization through proper pavement maintenance to support smooth driving and reduced rolling resistance, and traffic signal coordination[15], which helps to reduce congestion and non-productive vehicle idling at red lights. Caltrans is responsible for the highways within Fremont and uses strategies such as ramp metering and real-time traveler information to help cars move smoothly onto and along a highway.

However, Fremont's roads are not used exclusively by drivers. Bicyclists, pedestrians, and transit vehicles all use Fremont's transportation system, including sidewalks and trails. The City's challenge, then, is to balance the requirements for optimal traffic flow with the need to provide a safe and efficient system for bicyclists, pedestrians and transit vehicles so that people will increasingly chose these ways for getting to where they need to go, instead of driving alone (or driving at all).

Fremont identifies priorities for projects which expand and improve the City's pedestrian and bicycle systems, provide user amenities, and remove barriers for pedestrians and bicyclists through two separate but interrelated documents: the Pedestrian Master Plan (adopted by the City Council on December 4, 2007, and scheduled to be updated in 2012-13) and the Bicycle Master Plan (adopted by the City Council on September 27, 2005, with an updated version scheduled for adoption in 2011). Funding for specific projects is allocated through the City's biennial Capital Improvement Program Plan. Physical improvements are supplemented by educational programs aimed at increased walking and bicycling. The Climate Action Plan supports the ongoing use of these master plans for guiding Fremont's investments in bicycle and pedestrian improvements and for advancing the Climate Action Plan's primary goal of achieving greenhouse gas emission reductions community-wide.

Electric vehicle charging stations

The increased availability and desired use of alternative fuel vehicles has created a new challenge to system optimization: the development of charging

[15] Fremont utilizes traffic signal coordination on major arterials on weekdays during the morning peak, noon peak, and evening peak hours, to maintain optimal traffic flow and reduce congestion.

infrastructure to help make these vehicles a viable option for residents, businesses, and public agencies. The lack of charging infrastructure, which is both a local and regional issue, would be a constraint on wide-spread public acceptance and purchase of these vehicles. To address this issue as it pertains to electric vehicles, in February, 2011, the BAAQMD showed its commitment to a "robust charging infrastructure" by awarding $3.9 million to four companies to coordinate and deploy electric vehicle charging equipment throughout the Bay Area. The funding will be used for chargers in private residences and for public use at key transportation corridor sites throughout the region.

As the City of Fremont continues to increase the number and type of alternative fuel vehicles in its fleet, it will also continue to provide the required fueling infrastructure for those vehicles at various City-owned sites. For example, compressed natural gas fueling is available at the Development Services Center (DSC), and electric vehicle charging stations will be installed at two locations (the DSC and City Hall) to charge electric vehicles purchased in part through grant funding awarded by the Metropolitan Transportation Commission to the multi-agency *Local Government Electric Vehicle Fleet National Demonstration Project.*

Actions for Reducing Greenhouse Gas Emissions

The Climate Action Plan seeks to achieve the goal of reducing greenhouse gas emission from the transportation sector by facilitating transit-oriented development, conducting outreach and educational efforts to promote behavior change, and creating the conditions that support people's ability to make choices which support this goal. Meeting the City's ambitious greenhouse gas reduction goals in the transportation sector will rely heavily on State and regional initiatives, as previously discussed. However, individuals can make choices and change behaviors in ways that will also make a positive impact. Specific ideas for actions which individuals, businesses and organizations can take to help reduce greenhouse gas emissions from transportation can be found in the section titled "What You Can Do!"

Staff will collaborate with stakeholders when undertaking work on actions in this chapter, especially for those actions which may result in new local regulations.

For more information about the proposed actions to reduce greenhouse gas emissions from the combustion of fossil fuels in City of Fremont operations, as well as a description of current City programs that achieve emission reductions in this area, see Chapter Six, "Municipal Operations."

Emission Reduction Actions and Implementation Timeline

GOAL: Reduce greenhouse gas emissions by facilitating transit-oriented development, conducting outreach and educational efforts to promote behavior change, and creating the conditions that support people's ability to make choices which support this goal.

Short-term actions: 1-3 years from Plan adoption

Advocate

L-A1. Apply transit-oriented development principles at the Fremont, Irvington, and Warm Springs BART Stations, the Centerville train station, and the City Center, and consider other opportunities, particularly the Fremont Boulevard corridor.
Greenhouse gas emission reduction potential through 2020: 11,000 $MTCO_2e$

L-A2. Continue implementation of the City's Pedestrian Master Plan to improve pedestrian infrastructure (such as sidewalks and conveniently located crosswalks) for walking throughout the community, in order to support increased pedestrian trips.
Greenhouse gas emission reduction potential through 2020: 1 $MTCO_2e$

L-A3. Continue implementation of the City's Bicycle Master Plan to improve bicycle infrastructure, in order to support increased bicycle trips.

Collaborate/participate

L-C1. Cooperate with regional agencies seeking to develop a network of fuel stations for vehicles using electricity, biofuels, and other non-fossil fuel energy sources.

L-C2. Collaborate with other agencies and the State of California to disseminate information about the "Just Check It" program, which addresses the importance and benefits of proper tire inflation.

Promote/encourage

L-P1. In newly constructed and remodeled non-residential buildings, encourage the provision of amenities, such as showering and changing facilities, to enable walking and bicycle use by employees.

Regulate

L-R1. Require employers to provide preferential parking for carpools.

L-R2. Require Transportation Demand Management strategies be implemented when developments outside transit-oriented development areas request increased development capacity (e.g. increases in floor area ratios).

L-R3. Require new sidewalk construction to meet the five-foot width minimum requirement, to enhance usability by pedestrians and those using mobility devices.

L-R4. Require applicants for private schools to submit plans for managing vehicular movement and parking which serves the school, and include, as a condition of approval, measures to address vehicle idling.

L-R5. Prohibit redesignation and rezoning of land for lower intensity land uses in transit-oriented development areas, areas within walking distance of basic services, and other areas served by transit systems.

L-R6. Consider requirements to provide pre-wiring for electric vehicle charging in new home construction as part of a Green Building program.

L-R7. Require new developments, particularly those within transit-oriented areas and along transit corridors, to provide pedestrian, bicycle and transit amenities as a condition of approval.

Medium-term actions: 3-5 years from Plan adoption

Collaborate/participate

L-C3. Collaborate with regional transportation agencies and the Chamber of Commerce to provide information about, and access to, incentives and services to increase the use of alternatives to single-occupant auto commuting, for employers of all sizes throughout the community. Examples

include the Commuter Check and Bicycle Commuter Check Programs.

L-C4. Partner with regional transportation agencies to encourage and facilitate the development of car-sharing, carpooling and other services that reduce the need to own a personal motor vehicle.

Promote/encourage

L-P2. Encourage employers to provide transit subsidies, bicycle facilities, alternative work schedules, flextime, telecommuting and work-at-home programs, and other measures to reduce peak hour travel demand.

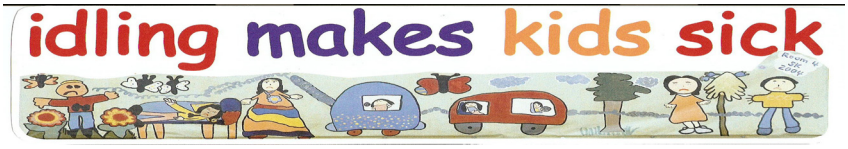
Regulate

L-R8. Adopt regulations restricting locations of drive-through businesses to reduce the impacts of vehicle idling on adjacent uses, such as housing, schools, and health care facilities.

Long-term actions: 5-10 years from Plan adoption

Collaborate/participate

L-C5. Partner with both public and private educational and childcare institutions to address vehicle idling at drop-off/ pick-up locations serving the institutions.



L-C6. Partner with BART, Washington Hospital, Kaiser Permanente and other large institutions to address vehicle idling at their facilities, through a public education campaign, signage, and enforcement program.